The Antikythera Mechanism on the OLPC

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Overview

- Overview of the Antikythera Mechanism
- OLPC initiative
- OLPC platform
- Squeak and EToys
- EToys implementation
Antikythera Mechanism

- Discovered 1900
- Dated 150-100 B.C.
- At least 35 gears
- Astronomical calculator
- Studies
  - D. de Solla Price (1960)
Front Dial Function

- Sun Zodiac position
- Moon Zodiac position (anomalistic month)
- Moon phase
Front Dial
Luni-Solar Calendar

- Meton
  - 29 ½ day synodic month
  - 19 seasonal years contain almost 235 synodic months

- Callipus
  - cycle containing 125 full months of 30 days
  - 110 hollow, 29 day, months
Eclipse Prediction

- Saros cycle
  - 223 $\frac{1}{3}$ synodic months
- Exeligmos
  - Three Saros cycles

- Software engineering
  - Lookup table
  - Design pattern for increasing the resolution
Back Dial

Saros

Metonic

Exeligmos

Callippic
Educational Context

- Astronomy
- Arithmetic
- Geometry
- Mechanical engineering
- Physics
- Archeology
- Computer science
- Science
Computers are tools

Imagine a writing lab…

Build an affordable machine tailored to children

OLPC as an enabler
  - Learn by doing
  - Experiment
  - Communicate and collaborate
  - Access knowledge
Platform Overview

- Sturdy
  - No hard disk
  - Spill proof keyboard
- Thrifty on power consumption
- Size, weight, form suitable for children
- 1200×900 screen readable under the sunlight
- Book mode
- Mesh networking
- I/O for experiments
Software Overview

- Linux
- X11
- Sugar
  - Web browser
  - Paint
  - Write
  - Slideshow
  - Camera
  - Tam-tam
  - Squeak EToys
Squeak

- Smalltalk in the 21st century
- Re-implementation of Smalltalk in Smalltalk
- VM-based
- Runs bit-identical images on any platform
EToys

- Visual programming environment
- Built on top of Squeak
- Suitable for
  - building learning activities
  - learning by doing
Basic Idea

- One interface mechanism
  - Available everywhere
  - Controlling everything

- No distinction between producers and consumers
  - Children can explore and change what they’re seeing
A Simple Example

- Let’s draw a flag
Processing
A Student’s Toolbox
Programming

- Everything is an object
- All objects have similar properties
- We can modify properties by direct manipulation
- Programming is the changing of properties
EToys Context

- EToys lacks
  - sophisticated data structures
  - mathematical functions
  - bitmap drawing primitives
- Use facilities that children can understand
- Avoid
  - trigonometry
  - vectors
  - calculus
Polygons

- Add a side
- Increment the X and Y coordinates
- Add a side
- Increment X, decrement Y
- Rotate
Calculating with Gears

- Gear A: 24 teeth
- Gear B: 16 teeth
- Ratio: 24/16 = 3/2
Functional Decomposition
Gear Placement

- North
- South
- East
- West
- coCenter
Gear Movement

- Concentric: maintain heading
- Engaged: rotate if overlapping
Example: Luni-Solar Calendar

start luniSolarOperate
m2 sameHeading: ml
nl adjustCcw: m2
n2 sameHeading: nl
p1 adjust: n2
p2 sameHeading: p1
o1 adjustCcw: p2
Eclipse Prediction
Sidereal Month
Hipparchos’s Mechanism

[Diagram with labeled parts: m1, m3, e3, i2, k2, pin, slot, k1, e6, b2, b3, e5, e1]
Tens of Other Applications

- Go Fish
- WallFollower
- Ecosystem
- Fishland
- Teds Ocean
- Gas Station
- Stair
- Digestive System
- R & J Maze
- 2 level Maze
- Aquarium
- Multi-instance simulations
- Inclined Plane
- Water Cycle
- Countries
- Plankton
- Far Out Flowers
- Ball and Stairs
- Faceball
- Dragon Animation
- Horse Animation
- Duck! It's Barfin Bill
- Hula Hippo
- Elena's Cat and Dog
- Froggy
- Brickout
- Avoid the Boulders
- Ducks in a Pond
Contact Details

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